

10/11/16 "Champions keep playing until they get it right." Billie Jean King

HW: "Finding Equations of Tangent Lines HW" #1-15 odd

Test 2 on Wednesday 10/19

AIM: How do we find equations of tangent lines?

Warm Up:

SIT DOWN QUIETLY

FINDING EQUATIONS OF TANGENT LINES

To find the equation of a tangent line to a function at a specific point:

1. Find the y -value of the point on the graph by substituting in the given x -value into the original equation. (Function)
2. Find the derivative of f .
3. Evaluate $f'(x)$ to get the slope of the graph... THIS MUST BE A NUMBER!
4. Now you have the two basics for any equation of a line, a point and a slope. Use the point-slope formula to write the equation for the tangent line at the given x -value.

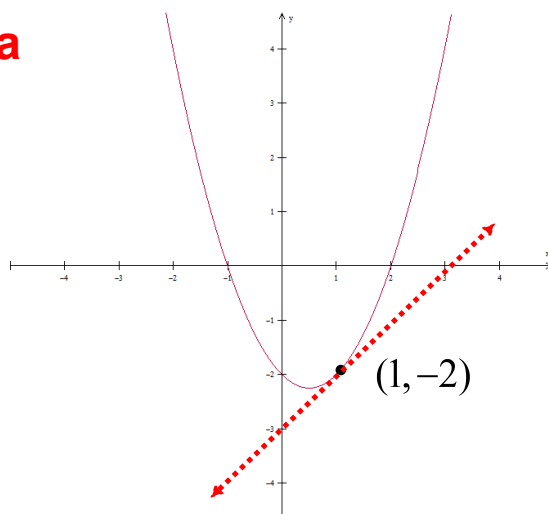
$$y_2 - y_1 = m(x_2 - x_1)$$

Point
 (x_1, y_1)

m is slope

EX #1: The graph of $y = x^2 - x - 2$ is shown below.

The slope of a graph at a point is the value of the derivative at that point.



A.) Find the general derivative of the function.

$$y' = 2x - 1$$

B.) Find the point on the curve when $x = 1$.

(function)

$$y = x^2 - x - 2$$

$$y = 1^2 - 1 - 2$$

$$y = -2$$

Point

$$(1, -2)$$

C.) Find the slope of the tangent line at this point.

(derivative)

$$x = 1$$

$$y' = 2x - 1$$

$$y' = 2(1) - 1$$

$$y' = 1$$

Slope = 1

D.) Write the equation of the tangent line to the graph.

$$y - (-2) = 1(x - 1)$$

$$y + 2 = x - 1$$

$$y = x - 3$$

E.) Draw the tangent line on the sketch and label the point of tangency.

EX #2: Let $f(x) = 4x^3 - 5x + 3$. Find the equation of the line tangent to the graph of f at $x = -1$.

Point:

$$f(-1) = 4(-1)^3 - 5(-1) + 3$$

$$f(-1) = 4$$

$(-1, 4)$
point

Slope:

$$f'(x) = 12x^2 - 5$$

$$f'(-1) = 12(-1)^2 - 5$$

$$f'(-1) = 7$$

$$\text{Slope} = 7$$

$$y - 4 = 7(x - (-1))$$

EX #3: Given the differentiable functions, $f(x)$ and $g(x)$.
Using the table below,

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
6	-3	7	2	-4

A.) Find the equation of the line tangent to $g(x)$
at $x = 6$.

Point:
 $g(6) = 7$
 $(6, 7)$

Slope:
 $g'(6) = -4$

$$y - 7 = -4(x - 6)$$

B.) Find the equation of the line tangent to $f(x)$
at $x = 6$.

Point:
 $(6, -3)$

Slope:
 2

$$y - (-3) = 2(x - 6)$$

Finding an Equation of a Tangent Line

EX #4: Find the equation of the line tangent to the graph of $f(x) = x^4 + 2x^2$ at the point where

slope $f'(x) = 2$. Round all values to three decimal places. Need both x and y of the point

Slope:
2

$$\begin{aligned}f'(x) &= 4x^3 + 4x \\2 &= 4x^3 + 4x \\4x^3 + 4x - 2 &= 0 \\x &= .424\end{aligned}$$

Point:

$$\begin{aligned}f(.424) &= (.424)^4 + 2(.424)^2 \\f(.424) &= .392 \\&(.424, .392)\end{aligned}$$

$$y - .392 = 2(x - .424)$$

EX #5: Given $f(x) = k - x^2$ find the value of k ,
such that the line $y = -6x + 1$ is tangent to the
graph of the function.

Slope = derivative
@ point of tangency

① At the point

$$k - x^2 = -6x + 1$$

$$k = -8$$

② $f(x) = k - x^2$
 $f'(x) = -2x$

$$\frac{-6}{-2} = \frac{-2x}{-2}$$
$$3 = x$$

③ use $x = 3$

$$k - 3^2 = -6(3) + 1$$

$$k - 9 = -18 + 1$$

$$k - 9 = -17$$

$$k = -8$$